Title: 'Waste? You mean by-products!' From bio-waste management to agro-ecology in Italian winemaking and beyond.

Abstract: This paper engages in a critique of Italian and EU agricultural bio-waste policy, taking a relational approach to understanding the role of these materials in socio-material networks of production. I consider how the challenges posed by excess materials of agricultural production fit into larger concerns about rural sustainability, both social and environmental. Drawing on a number of case studies from the Italian winemaking industry, I demonstrate the legislative creation of waste from the by-products of winemaking such as grape marc and vine wood. By physically removing bio-wastes from the socio-material context of their production, the current legislation privileges capital and technology intensive methods for their management. This results in environmental contradictions, and an unequal distribution of economic and societal benefits from the utilisation of bio-wastes. What is needed, I argue, is an incorporation of excess materials into ways of thinking about local agro-ecologies as environmentally, economically, and culturally sustainable.

Introduction: relational materiality of bio-wastes

In recent years, social sciences have started making important inroads into the issues of food wastes. However, attention has been mainly directed to post-consumption food wastes (Evans 2011, 2012, Quested et al. 2011). Macro food wastes, and especially bio-wastes - resulting from the production rather than the consumption of food-stuffs - remain under explored.[iii] In this article I demonstrate that the political, regulatory, and economic pathways of those excess materials are important to thinking about risk, and ecological and economic sustainability in the context of agro-food production.

In this article I examine the socio-material pathways of bio-wastes in the Italian winemaking industry, and demonstrate the importance of social and material relations to the valuation of these materials. The pathways of the excess materials of winemaking are strongly informed by legislation on the one hand, and by the increasingly institutionalised preference of capital markets for 'profitable' methods of bio-waste re-valorisation, on the other. In accordance with Gille (2010), I suggest that the labelling of materials as wastes is not necessarily linked with the politics of value, or indeed with environmental concerns. What waste legislation affords is a uniquely powerful regulatory intervention into the spaces of agro-food production as sites of risk, be it environmental or economic. This kind of waste legislation works by severing the socio-material connections which link excess materials with their local context, often physically lifting these materials from the hands of their producers. With regard to winemaking bio-wastes in Italy, the current legislation privileges techno-scientific and capital-intensive methods of waste revalorisation to the detriment of local and potentially less environmentally and socially harmful solutions. The legislation results in environmental contradictions and in an unequal distribution of economic and societal benefits from the utilisation of bio-wastes. Different, and potentially nourishing and productive uses for winemaking's excess materials, the local knowledges which relate to these uses, and the metabolic relations between society and nature on which agro-food activities such as winemaking depend, are devalued in favour of distant capital markets (FitzSimmons and Goodman 1998).

In this paper, I consider how the challenges posed by waste materials fit into larger concerns about rural sustainability, both economic and environmental. Mechanisms of waste regulation in the Italian winemaking sector are typical of the wider trends in rural governance, particularly the hygienic-bureaucratic mode of governance which imagines rural spaces as spaces of risk (see Lee and Marsden (2009), Marsden (2003), and Morgan et al. (2006). An important consequence of this arms-length governance is an institutionalised blindness to questions of scale (Haila 2002), and, in consequence, to the local specificity of materials in social and ecological relations. I argue that to integrate winemaking's excess materials into sustainable rural landscapes we must be sensitive to the materiality, temporality, and spatiality of these bio-waste materials. Local actors, such as wine producers, can show great inventiveness when it comes to reincorporating bio-waste materials into economically and socially significant flows of transforming matter. Appropriately aided by waste management regimes, these actors can contribute to the realisation of bio-waste materials as crucial elements in the achievement of local alternatives to the agro-industrial model of food production, as called for by many authors (for a discussion, see Horlings and Marsden 2011).

Before engaging with the ethnographic material on which this paper is based, I present some background information about the research, and consider the particularity of researching issues of waste with organic wine producers. In the following section, I query the dominant notion of 'waste' in agriculture, questioning its hygienic bureaucratic mode of managing rural nature (Marsden 2003). I discuss the implications of the hygienic bureaucratic agricultural waste regime in the context of vine wood burning, and point to the environmental contradictions it results in. In the later sections, I look more closely at the power of 'waste' as a legislative tool. Against the reification of materials into 'wastes', I offer examples of innovation where producers sought to re-value resources locally, thus keeping the environmental impact low, as well as benefitting financially. I will close the article by discussing the challenges posed and opportunities offered by the relational materiality of bio-wastes in the context of rural sustainability.

Research context

The data informing this chapter comes from a year-long ethnographic study of wine production in Northern Italy, conducted between 2008 and 2009. The research included interviews with producers, oenologists and viticultural workers at twenty wineries in Northern and Central Italy (Piemonte, Veneto, Abruzzo, Marche and Toscana), and prolonged periods of participant observation at four of these sites. For the purposes of this article, additional phone interviews were conducted with six of the original participants.

The majority of producers interviewed for this research produced wines from organically or biodynamically grown grapes. At the root of both these approaches lies the ideal of farms as metabolically closed units of nutrient and energy circulation, in which, in the words of the EU organic agriculture regulation, 'wastes and by-products of plant and animal origin should be recycled to return nutrients to the land' (EC No. 834/2007 of 28 June 2007). Both the organic, biodynamic, and conventional producers showed a considerable awareness of, and interest in, bio-waste regulation.[iii] Most producers were likely to question the existing bio-waste

management solutions on ecological grounds, and to seek out alternative pathways for the utilisation of these materials. As will become clear in the following sections, these producers showed real ingenuity and inventiveness in making value around winemaking waste materials.

Reutilising waste materials is currently seen as a sign of environmental consciousness, as well as good business practice. Indeed, for the organic and biodynamic companies in my research, waste reutilisation was seen to add further 'green credentials' to their company image. A particularly interesting example of how waste materials were re-valued was the recovery and reuse of wooden barrels at the La Carina winery.[iv] At La Carina, red wines were matured in oak barrels. Each barrel was used for a maximum of four years, after which time its capacity to impact on the wines' taste diminished. The cost of replacing the barrels was considerable, and, as the market for used barrels is rather small, resulted in large amounts of wasted wood. The owner of La Carina found a way of recovering both a significant amount of the capital invested in the barrels, and of using the materiality of oak wood to add environmental value to his company. In collaboration with a Swiss barrel-maker, a share of the traditional barrels was gradually replaced with highly unusual square ones. The unorthodox shape made it possible to recover its wooden planks once the barrels had served their original purpose. Coloured and hardened by the tannins which passed through their pores during the wine maturation process, the planks could then be used for flooring, panels or furniture. This spectacular reutilisation of waste could be admired in the La Carina's tasting room, floored with the unique, and ecological, rusty planks.

Fig. 1: Square barrels at La Carina.

This spectacular reincarnation of wood waste is the kind of story which is likely to make the headlines. The appealing materiality of wood is immediately graspable, the value recovery process easily understandable. Such stories of win-win waste revalorization fit comfortably into the vision of the world as a manageable system of production: a vision put forward by ecological modernization approaches, as I explain further below. However, very few excess materials of agri-food production offer such straightforward ways of revalorisation. On the contrary, when dealing with (a)mass(ed) agri-food bio-wastes, we are dealing with materials whose characteristics are not immediately graspable. In contrast to trash (Reno 2009), these materials challenge our capacity to ascribe use-value. In the local context of production, the knowledge of local actors can contribute to finding less environmentally harmful or even potentially beneficial ways of managing bio-materials. However, as I will show in the following sections, in Italian winemaking this local connection is hampered by regulation which physically removes bio-wastes from the socio-material context of their production. Detached and abstracted, these materials become valued in relation to their money-making potential on the 'waste materials' market. Research laboratories break up these materials into chemical components, and devise methods for extracting the (currently) most valuable elements (such as anti-oxidants from grape skins). Thus capital- and resource-intensive ways of managing bio-materials become preferred over local, low-impact solutions.

From matter to waste in wine production

Before we proceed, the concept of waste in agriculture needs to be addressed. The counter-intuitiveness of imagining waste in the context of agri-food production was a frequent stumbling block in my conversations about waste with the participants of this research. 'Waste? Well there are the bottles, the paper… Ah, you mean by-products', they would exclaim. The idea that agri-food production such as winemaking creates waste is not immediately obvious, and has a particular historical trajectory. As Barry (2007) notes, nature itself knows no waste'. In order to become waste something has to be no longer needed – it has to have been 'used up', like the oak barrels in the previous example. In nature, however, nothing 'is ever used up because nothing is, strictly speaking, used – (…) nothing in nature has an end, purpose, or design' (Barry 2007 p. 203). The other dimension which designates matter as waste, that of risk pollution or toxicity (Douglas 1966, Van Loon 2002), is also not automatically satisfied; agricultural by-products achieve toxicity only when highly concentrated. As a result, pre-agri-industrial agricultural activity was not seen to be linked with waste. The rural landscape was portrayed as a space devoid of waste, and contrasted with the pollution of the cities (Macnaghten and Urry 1998).

The idea of agri-food waste is linked with the intensification of agri-food production, which became the paramount aim of post-WWII rural policy in Europe (Lowe et al. 1997). This in turn resulted in agricultural pollution, soil degradation, and increased concerns about the quality of agricultural produce amongst farmers and consumers alike (Atkins 2011). The public and policy reaction was not to question the premise of the agri-industrial system, but instead to recast agriculture itself as a 'dirty business' and a threat to the unspoiled nature of the countryside. From a site of nature, agriculture became a site of risk. The risk posed by agri-food materialities to both rural environments and the bodies of consumers was to be contained through an increase in state intervention into all aspects of agri-food production. In this bureaucratic-hygienic mode of agri-food production (Marsden 2003), the spaces and material flows of agricultural production came under scrutiny by a plethora of quality, health and environmental protection bodies. The multiplication of regulations, top-down certifications, and penalty systems is still a feature of the (European) agri-food landscape today. Importantly in the light of my argument, the regulatory maze has been found to prevent rather than encourage the emergence of more ecologically sensitive approaches to agri-food production (Marsden 2003).

Navigating the regulatory maze

The bureaucratic and financial strain of conforming to an ever increasing number of quality and environmental protection regulations was an issue frequently raised during the course of my research. In contrast to Gille's waste regimes - that is, social institutions which determine the 'production, circulation, and transformation of waste as a concrete material' (2010: 1056) - waste regulations at work in the Italian winemaking sector do not express a singular logic. The waste regulations that impact on the flows of matter in wineries and vineyards derive from various levels of governance (regional, national, or European), and are not necessarily wine-industry specific. Typically, they express a reaction of governance bodies to particular concerns about agri-food materials as sources of risk. These risks can be posed to the environment, as in

the following examples of grape stalks and vine wood, but also to markets, as I explain further with regards to the grape marc regulation.

A diversity and multiplicity of waste-related regulations, combined with low levels of law enforcement, poses problems of compliance, and Italian wine producers frequently find themselves working in ignorance of the law. An example will illustrate this point. One of the companies in my research, Podere San Cristoforo , were faced with significant changes to the management of their bio-wastes when they applied for the ISO 14000 environmental quality certification. In the course of the audit it transpired that the company had been acting outside the law. They had been disposing of grape stems, which are separated at early stages of wine making, as green compost in their own vineyards. However, in their region of Abruzzo grape stems were legally categorised as non-hazardous wastes. This triggered a set of by-laws which required the company to involve an external contractor for their controlled removal and disposal. The company sought to avoid the additional cost that such controlled disposal methods would introduce. Podere San Cristoforo was in a relatively privileged situation in that its financial standing allowed it to involve an external legal consultancy firm, which identified a convenient loophole. By applying for a status of green waste disposal company, and jumping through a number of (costly) legal hoops, Podere San Cristoforo was allowed to continue the same practice they had been employing for decades, albeit under a different guise.

The fragmentary and reactive character of excess material regulation in Italian winemaking can be further seen in the case of vine wood. This excess material, which is produced every year during vine pruning, has recently seen increasing levels of regulation as a result of fire safety and air pollution laws. The debate culminated in December 2010 with a national regulation in which vine wood was designated as 'waste'. As a result, producers of vine wood are forbidden from processing it in any way excepting electricity production through incineration (DL n. 205 of 03/12/2010).

The impact of this law on excess materials is considerable. Every winter vineyards in Italy generate between two and two and a half tons of vine prunings per hectare (Corona and Nicoletti 2010). Traditionally the branches were burnt in the vineyards, and the ashes spread on the ground. The ashes provided a readily available fertiliser, and prevented the spread of vine disease carriers, such as fungi and bacteria, which winter in the wood. More recently, fearing hefty fines, many producers began to till the branches into the soil of the vineyards. As a consequence some areas have seen significant increase in vine diseases. This has led some to conclude that vine shoots should be removed for disease prevention, presenting producers with a problem of disposal – two and a half tonnes per hectare is a lot of wood! Fortunately for the producers a loophole was found: while the burning of vine shoots directly in the vineyards is prohibited, the same shoots can be burned in domestic stoves as a source of heating. The idea of collecting vine prunings and using them as bio-mass for the production of heat, or even electricity, took root in the Italian winemaking community.

The idea was taken up by organic and biodynamic producers in particular. Utilising vine wood for heating was in line with their general interest in environmental sustainability issues, and a number of producers I spoke with had attempted to make use of this energy resource.

However, while the legislation pointed to a route from waste to energy, the material, temporal, and spatial conditions of vine wood production were ignored by the regulatory framework. Collection of the wood is difficult. Many vineyards are planted on steep slopes accessible only by machines of appropriate size, and with difficulty during the pruning season when the ground is wet and tractors can easily slip, damaging the vines and the machinery. Additionally, vine wood burns quickly, and needs to be compressed into bales or briquettes to be an efficient source of energy.

Using vine wood locally and legally requires a large investment of both capital and time. Nonetheless, a number of organic producers in my research sought to make use of this material. One producer began collaboration with a company which utilised vine shoots and other woody discards to make briquettes. The producer took on a significant time and financial cost associated with the collection of shoots (estimated by Corona and Nicoletti (2010) to exceed 100 euro per hectare). This collaboration, however, only lasted one season. The producer was struck with the paradox of the situation: his vine shoots travelled a large distance to be processed, and then another distance to be distributed to clients. When the briquettes burn, the producer hypothesised, they must surely release polluting chemicals, 'the glues they use to keep it together'. The environmental impact of producing and burning briquettes must therefore be significant. The irony of polluting legally where illegal burning would result in less pollution was not lost on this producer. Disenchanted, he decided to continue tilling the vine shoots into the ground, as he had done before.

Another producer, the owner of La Luna, became passionate about biomass energy generation. The idea of heating both his house and his winery with bales made of vine wood from his vineyards was appealing both as a financial saving, and as a step towards the material self-sufficiency that organic agriculture strives towards. The producer made calculations into the possibility of heating his house and winery with bales made from vine prunings collected in his and his neighbours' vineyards. He also borrowed a bailing machine, and created some experimental vine wood bales. He found, however, that to make a good use of the quick burning vine wood he would require an advanced stove with regulated air flow, and a mechanised feeder to top up the stove automatically. The capital investment required was too large and no funding streams were available. When I visited La Luna in 2009, grass was growing on the experimental bales.

Fig. 2: Bales made from pruned vine wood at La Luna.

Regulatory abstraction of excess materials

The examples discussed above illustrate the ingenuity of wine producers in making value around excess materials produced in their vineyards and wineries. The regulatory creation of waste poses many problems to these producers, but it can also act as a spur to seek new ways of utilising excess materials. However, finding ways of utilising bio-wastes which are both legal and locally relevant are difficult due to how these materials are conceptualised in the regulatory framework.

The regulation which both creates and controls bio-wastes in Italian winemaking operates by rupturing the local material, spatial, and temporal relations of their production. In the regulation, excess materials of wine production are labelled as either 'special' (hazardous), or 'normal' (non-hazardous) wastes. These labels define the spatial pathways of these materials, either lifting them from the context of their production, or enabling local solutions. When excess materials are labelled 'special waste', the control of their pathways is taken out of the hands of producers, and placed in the free market (unless otherwise specified). The movement

and transformation of these materials becomes the purview of companies which physically remove them from their local contexts. As a result, the social and material relations which could give those materials value locally (as sources of fertiliser, compost, or warmth) are severed. Instead, the value of these materials becomes linked to the sphere of the liberal market. This, as I discuss further below, results in a privileging of capital intensive socio-technical methods for utilising bio-wastes, with the consequent unequal distribution of benefits, both ecologically and socially.

As could be seen in the example of vine wood regulation, the same legislation which inhibits local methods for the utilisation of bio-materials promotes valorisation methods more in line with the ecological modernisation (EM) agenda. EM is seen by many scholars as the primary method for Western countries to address their environmental problems (Blühdorn 2001, cited in Baker 2007: 297). Many commentators agree that, implicitly or explicitly, EM has been the dominant conceptual framework for European environmental regulation over the last two to three decades (Baker 2007; Korhonen 2008). In the EM approach, all ecological problems are seen as solvable through a combination of regulation and free market competition. With regards to waste management, EM has been critiqued as an approach founded on a techno-scientific 'alchemist's dream' (O'Brien 2008), which proposes a conflict-less marrying of economic prosperity and environmental sustainability through waste re-valorisation. In an ideal world of EM production, waste and resource become one and the same thing as companies - connected through mutually beneficial networks - constantly utilise one another's wastes instead of virgin resources (Pellow et al 2000). This is a vision of economies mimicking ecosystems, with an important twist. While the vision is inflected by the idea of cyclical time and an eternal return of the same material in different guises, it also includes the linear time of techno-scientific progress, and a progressive expansion of the economy (Van Loon and Sabelis 1997).

In both the context of production, and in the context of waste management, the EM approach can be seen to annihilate both time and space, and to conceptualise the materiality of wastes as inherently malleable, transformable, and available. However, the excess 'stuff' of vitiviniculture presents serious challenges to this approach to materiality.

As we can see in the vine wood example, whilst wine producers face increasingly strict regulations of the flows of materials, they are also being encouraged to imagine themselves as ecological entrepreneurs (Marsden and Smith 2005, Reno 2011). They are expected to pursue state and European level environmental scheme payments, and to diversify their production and marketing activities to incorporate a range of 'environmental' outputs. Converting vine prunings wood into energy and heat was, for the producers in my research, just such a possibility. However, the practical challenges of participating in this mode of re-valorisation - issues which relate to the specific material qualities of vine shoots, the topographies and soils of vineyards, the temporalities of vine wood production, as well as to issues of capital access for small and medium producers - make the application of these methods on such a small scale difficult, if not impossible.

The legislation which seemingly encourages more ecologically sensitive ways of managing excess materials such as vine wood is in effect blind to the materiality, temporality, and scale of such bio-wastes. As a result, it forecloses local, non-market linked sources of bio-waste valuation. These challenges are easier to manage for larger producers, who can benefit from the economies of scale. In the case of vine shoots, Corona and Nicoletti (2010) calculated that if a large cooperative winery in Sicily organized a collection of vine shoots from an area of 2,350 ha, and constructed and staffed an electricity generation site, the cooperative would be able cover the current cost of electricity consumption (with the help of the Italian feed-in tariff), or substantially reduce their spending (without it). The ecological cost of transporting the vine shoots, the ecological problems associated with their concentrated incineration, and the lack of advantage for the medium and small producers supplying the necessary material would not obtain in this account.

In the previous sections, I focused on instances of regulation based on the branding of winemaking's excess materials as environmentally hazardous. In the following, I discuss how the category 'waste' has been employed as a market protection mechanism. This example highlights the independence of waste regulation from the modes of production, as noted by Gille (2010). In European wine regulations, the category 'waste' is used independently from notions of environmental risk and pollution, and serves as a powerful tool for regulating unwelcome productive activity at the wineries.

Protecting wine markets from grape marc 'waste'

All the producers in my research were affected by the grape marc disposal obligation, one waste regulation which was thoroughly enforced.[v] Marc became a 'risky' material in the eyes of legislation not due to its polluting characteristics, which are not significant, but due to the threat it was seen to pose to high quality wine markets. After the first pressing, water can be added to the grape skins, a second pressing can be undertaken, and the weaker juices fermented to make a low-grade, low-quality and cheap alcoholic drink known in France as the *piquette* (Unwin 1991) The over-production crises in the 1970s and 80s, and the resulting increase in regulation of wine production in Europe cast the presence of marc at the wineries as a threat to the profitability of the wine industry. Designating grape marc a non-hazardous organic waste in the EU Common Organisation for Markets (COM) in Wine (EC n. 1493/19991) was a quick way of removing the danger. The legislation introduced compulsory distillation of wine by-products, including marc. Distilleries were paid a subsidy to distil the alcohol, which was then ear-marked for industrial and energy uses. By being branded as 'waste', marc became locked into what Gregson and Crang term the 'teleological fix' of waste management where 'that which is managed as waste is waste, and that which is waste is what is managed' (2010: 1027), blocking alternative pathways of utilisation.

During the period of my research in Italy (2008-2009), disposal of marc via distillation was becoming a considerable financial and bureaucratic burden for small and medium wine producers. Although the distilleries paid a small amount for the marc, it was the producers' obligation to pay for the cost of transport. As a result, and especially in more remote areas,

producers were not only being constrained to dispose of a potentially useful by-product, but were in fact subsidising the distilleries, with the marc transportation costs exceeding the price paid for it at the distillery. The market-protective legislation frustrated attempts at alternative uses of grape marc in the wineries. The arms-length management of marc lifted it from the local ecosystem of grape production into the materially and spatially abstract category 'waste'. The result was a devaluation of local knowledge of ecosystems and material cycles in favour of market protection. Importantly for the organic producers in my research, the marc distillation law also struck at the heart of the organic principles of closed material circuits, recycling of nutrients, and farm self-sufficiency.

As a result, the distillation law did not go uncontested. In one case, a producer freely admitted to me that he had an understanding with a distillery, which provided him with false receipts for the transport of marc so that he could compost it and use it as a vegetal fertiliser in his vineyards. A small distillery owner similarly confirmed that his company provided some of the producers with 'adjusted' receipts, exaggerating the amount of marc actually received. Other companies in my research were also involved in a re-valorisation of marc on a local scale through small-scale in-house distillation, making local speciality foods such as a sweet preserve called *cunia*, and for cheese affinage. All these activities were undertaken illegally due to the obligation of marc distillation.

In the new European common organisation for the market in wine, introduced in 2008 (EC No 479/2008), nation states were granted more autonomy in deciding the exact mechanisms of marc management. In Italy it was decided (Disposizioni Nazionali DM 27/11/081) that marc could either be distilled, or utilised by producers in other ways under supervision of national industry and environmental control bodies. The alternative uses allowed included energy production via anaerobic digestion or incineration, spreading on agricultural land (raw or composted), and use as a raw material for a production of other goods such as cosmetics and pharmaceuticals.

This change had the potential to encourage both local and perhaps less environmentally damaging solutions to the marc 'problem' through (legal) on-farm utilisation. However, in practice the new legislation continued to enact a strong preference for techno-scientific rather than agro-ecological solutions to bio-waste management. The most cost effective method of marc disposal for producers is composting for use on their own land. The benefits of using composted marc in vineyards have been the topic of some research in recent years, and the data supports the already existing agricultural practices of raw and composted spreading on the fields (Ruggieri et al. 2009). The post-2008 change in marc regulation in theory made it possible for producers to close the nutrient cycle and return marc to the vineyards as fertiliser. However, in practice the administrative burden of disposal under supervision from industry and environmental control bodies meant that distillation was still the easiest - if not the least costly - method for small and medium producers. One of my research participants described the situation to me: 'the bureaucracy is terrible (…) One has to declare the intention five days before the disposal describing how much marc was produced, if the grapes were your own or

someone else's, declare where and when they will be spread in the fields, or given to someone who produces energy or whatever. (…) In theory it's all simple, but in practice..!'. To ensure the marc is disposed of in an environmentally sound manner, the process is closely controlled by the Guardia Forestale (a specialised police force under the jurisdiction of the Ministry of Agriculture), which appears twenty days after the operation is disclosed to take soil samples, photograph the area, and control winery documentation. Any omissions or mistakes in the procedure are penalised.

Value of bio-wastes and economies of scale

Even under more recent marc regulation, the legislative and financial burdens shouldered by small and medium producers for marc disposal are incommensurable with the benefits accrued by large companies. Distillation subsidies play an important role here.. Distilleries, which are frequently part of large winemaking cooperatives, are subsidised by the European states for the distillation of grape marc. In Italy in 2010 alone 23.6 million Euros were spent from the EU agricultural support budget on wine by-product distillation support payments in Italy (MIPAAF 2011). Furthermore, the regulation of marc as excess material works to tie its value potential to the value of its particular chemical components (such as anti-oxidants). This in practice means encouraging private investment into techno-scientific methods for value recovery, an operation practically subsidised by small and medium producers who lose control over their excess materials.

The 2008 marc regulation opened new money-making potential for large processors, as wine by-products became available for the production of energy through bio-gas generation or incineration, or by-product extraction for cosmetic and pharmaceutical use. One recipient of masses of wine bio-wastes was a wine cooperative Caviro, the single biggest wine producer in Italy, employing twenty thousand grape growers (Caviro.it 2011). In national and international media, Caviro presented itself as a forerunner of sustainable winemaking. Its main claim to 'green fame' were the operations of its Faenza winery, where grape marc was re-processed on a massive scale.[vi] After recovery of alcohol through distillation, the used marc was pressed and underwent a process of mechanical and chemical separation. The grape skins were dried and used for composting, fed into the on-site incinerator, or sold to be used as animal feed. Stalks were similarly incinerated. Grape pips were sold to oil-makers to be used in the production of grape-seed oil. The watery distillation residue was further processed to obtain crystals of calcium citrate, which was also sold.

Fig. 3: Mountains of grape marc at Caviro (source: Caviro.it).

The intense processing of marc allowed Caviro to valorise grape marc through a creation of by-products utilizable by other industries, acquiring the resulting financial and market benefits. Apart from recovering by-products from grape marc, Caviro has also been producing bio-gas, and generating electricity through incineration. The vineyard and winery bio-wastes, however, are only available seasonally (another characteristic of the material overlooked by the legislation). To secure a continuous supply of matter for its incinerator, in 2010 Caviro entered into collaboration with Hera, an urban waste management company, which would provide material for the incinerator from urban food wastes (Gruppohera.it 2011). This development raised a wave of public protest (Faenzanotizie.it 2009, 2011a, 2011b). It was feared that the Caviro winery incinerator, based well within the town boundaries, would be used not only for the burning of bio-mass, but also of mixed urban waste. Members of the public voiced fears over noxious smells from the incinerator, and the discharge of dioxins and other harmful particles into the air, in what is already the most heavily polluted region in Italy.

In spite of these public worries, Caviro continued to be portrayed as an emblematic example of the principles of ecological modernisation at work. Its public relations and financial success in winery bio-waste utilisation is illustrative of the institutionalised preference for large scale, techno-scientific methods for bio-waste management in the Italian wine industry. The ecological costs of the transport of marc from individual wineries to the distilleries, the energy and materials cost of the distillation, the ecological costs associated with the distribution and consumption of by-products which are not necessarily substitutes for raw materials, and the

public and social costs of these centralised operations are all silenced in this tale of successful ecological modernisation.

Bio-wastes and local agro-ecology

The above exploration of the role of bio-waste materials in the Italian winemaking industry has highlighted some serious shortcomings in existing bio-waste related regulation. It has shown that the spaces of wine production are regulated by waste legislation which works by physically disconnecting materials such as grape stalks, vine wood, and grape marc from the local socio-natures of their production. By creating 'free-floating' materials through legislation, waste policies actually work to draw ever more practices and processes into the fold of liberalised markets (Mincyte 2011). This situation places financial burdens on small and medium producers, restricts their access to the value of materials they produce, and results in a further disconnection of farmers from local nature. EU and Italian bio-waste policy can thus be seen to work against agri-ecological solutions to bio-waste management, and to contribute to the devaluation of local knowledges as valid ways of knowing agriculture (see also Clark and Murdoch 1997, Kaljonen 2006). What the policy expresses is a techno-scientific denial of the materiality (and temporality) of the agro-food world. As a result, the policy continues to prioritise economies and political economies of scale and concentration, while negating the importance of what Bunker and Ciccantelli (2005) call the diseconomies of the local, decentralised and ecological spaces.

It would be tempting to see this drive towards scientification and capitalisation of bio-wastes in the wine industry as an unfortunate side-effect of a fragmented and reactive policy approach. However, there is some evidence to suggest that capital market valuation of excess materials of winemaking is becoming not only a norm, but is being encouraged as an industry standard. In California, which has been a fore-runner of ecological wine production, the California Sustainable Winegrowing Alliance self-evaluation programme values technological solutions for bio-waste management over agro-ecological ones (http://www.sustainablewinegrowing.org). For instance, to obtain the highest (most sustainable) category for pomace and lees management, winemakers are required to remove marketable by-products from these materials by technological means. Composting these bio-wastes, feeding them to animals, or disposing of them off-site, are seen as less valuable in this assessment.

In Europe, the question of winemaking bio-wastes is at the moment of writing being tackled by the research project SUSTAVINO, funded under the EU Seventh Framework Programme (www.sustavino.eu). The aim of the programme is to establish an EU sustainable winemaking seal in order to enhance the competitiveness of the EU wine sector. While it is premature to judge the outcomes of this programme, I am worried by the stress on value recovery from winery waste materials through technological means in the materials published by SUSTAVINO. While techno-scientific methods for waste revalorization can indeed create marketable products, the wider costs of lifting bio-wastes from the localities of their production need to be given more consideration. The negative agro-ecological consequences of removing plant

residues from productive soils have been highlighted in various EU soil research programmes (e.g. Gobin et al. 2011, Van-Camp et al. 2004). Despite these findings, there has to date been no progress on directive level to encourage the re-incorporation of agro-food residues into productive soils. The current concerns with climate change, and the growing EU support for bio-mass incineration as an 'ecological' energy source, makes a future focus on plant residues as elements of agro-ecology even less likely. In light of this, it is probable that European winemaking's excess materials will continue to be constructed as more valuable as fuel or as raw materials for other industries, rather than elements of healthy agro-ecologies.

Towards re-localising bio-wastes

In this paper I have suggested that the regulatory mechanisms concerning excess materials of agro-food production need to move away from a focus on the market value of materials, and recognise, utilise, and capitalise on local agro-ecologies and local skills. I have argued that the relational materiality of bio-wastes must be seen as a key element of rural sustainability. The examples above describe how wine producers can show creativity and determination in creating (local) value around waste materials. Without romanticising local knowledge, I argue that these kinds of valuations are only possible when the perspective of situated actors on the materials' utility is taken into account. What this article is calling for then, is a legislation that recognises and nurtures the local and contextual relationality of bio-waste materials.

As the 2008 change to wine bio-waste management demonstrates, the EU excess material legislation is not insensitive to questions of sustainability. However, the current legislation promotes a particular version of sustainability, one which has more to do with the patterns of ecological modernisation than of agro-ecology. In spite of a seeming recognition of bio-wastes as materials that can be utilised locally, in practice the bio-waste legislation in the wine sector continues to be insensitive to the materiality and temporality of the 'stuff' it regulates. Like much environmental regulation (Meadowcroft 2002), it is underlain by the ingrained assumption that the world is ruled by fundamental laws of physics, not the phenomenological laws of lived experience (Adam 1998, Stengers 1997). By privileging investment into techno-scientific bio-waste management, the legislation fails to recognise farmers both as knowledgeable actors and as initiators of change. As a result the regulation does not serve the ecology of agri-food, but contributes to the technological modernisation of agri-food spaces. Opening up previously non-marketable materials to market exchange, it facilitates (further) accumulation of capital, and the intensification and deeper penetration of existing markets. The result of the legislation is not a disappearance of waste, but an increase in both waste and pollution.

While it is beyond the scope of this article to propose definite solutions to the challenges of temporality (Adam 1998) and scale (Haila 2002, Meadowcroft 2002) that bio-waste governance poses, it is possible to draw some lessons from both literature and existing practice. Latour (1998) notes that in every conflict in which the interests of 'nature' clash with those of the economies and/or national or local politics, it is very particular issues that are at stake: this river, that frog, this bio-material. For Latour, a focus on the socio-natural imbroglios of living in

landscapes, and a multiplication of controversies surrounding these practices of living, is a possible answer. He calls for an intensification of attention towards specific materials and locales, and an empowerment of the people whose lives are implicated in these particular socio-natural imbroglios. Latour's position is echoed in Marsden's (2003) call to re-embed physical and social natures into rural development processes, and to re-incorporate local knowledges into decision making. Following the pathway of controversy and local empowerment implies an attention to the materialities and temporalities of particular materials, and to the multiple roles they play in the human and non-human imbroglios in which they are implicated. In this vision of a world of networks, 'ecology has nothing to do with taking account of nature, its own interest or goals, but that it is rather another way of considering everything'(Latour 1998: 235), be it 'human' or 'natural'.

A change in focus from centralised to localised governance expressed by Latour, Marsden, and many others, is beginning to materialise. There has been a significant move towards multi-scalar and participatory environmental governance in Europe in the last two decades, although the success of these regulatory mechanisms has been difficult to evaluate (Newig and Fritsch 2009). Similarly the inter-dependence of human and 'natural' activity is slowly being recognised, as the EU begins to support environmental management which puts stress on 'action through landscape', rather than 'action for landscape' (Matthews and Selman 2006: 200). However, Matthews and Selman (2006) note that these more sophisticated regulatory frameworks continue to be dominated by economic imperatives. Conversely, the case studies presented in this paper show that we need to think about enabling ecological entrepreneurship (Marsden and Smith 2005) beyond the level of production.

What is needed is an incorporation of excess materials into ways of thinking about local agro-ecologies as environmentally, economically, and culturally sustainable. As the case studies in this paper have showed, there is no shortage of interest from local actors in creating locally relevant solutions to bio-waste management. I am reminded of the positive energy behind the drive towards the re-localisation of agro-food production, and its prolific (and successful) establishment of innovative, local chains of provisioning. This re-localisation of food production has now become stabilised, although not uncontested, in many rural areas in Europe (see e.g. Goodman 2004). Learning from the production landscape, we could similarly imagine managing excess materials at local and regional scales in more socially and environmentally sensitive ways. The difficult and silenced bio-wastes of agriculture must not be allowed to slip through the cracks of rural and environmental governance; they must become inherent elements of sustainability policies. By challenging the interests at the heart of current winemaking bio-waste legislation, I hope this article contributes to these important and urgent challenges.

Websites

California Sustainable Winegrowing Alliance (2012), http://www.sustainablewinegrowing.org, accessed 02/08/2012

Caviro.it (2011), *Caviro ed I suoi valori*, http://www.caviro.it/caviro.asp, accessed 29/11/2011

Faenzanotizie.it 12/12/2009, *Faenza, nel 2010 nuova centrale a biomasse per Caviro*, http://faenzanotizie.it/main/index.php?id_pag=23&id_blog_post=964, accessed 29/11/2011

Faenzanotizie.it 12/01/2011, *Fantinelli (Lega): 'Alla Caviro si nasconde un inceneritore di rifiuti?'*, http://faenzanotizie.it/main/index.php?id_pag=23&id_blog_post=6163, accessed 29/11/2011

Faenzanotizie.it 14/01/2011, *Fatti Sentire sull'accordo Caviro-Hera: 'L'energia da biomasse non è verde'*, http://faenzanotizie.it/main/index.php?id_pag=23&id_blog_post=6173, accessed 29/11/2011

Gruppohera.it 11/01/ 2011, *Herambiente e Caviro: partnership per produrre energia rinnovabile da biomasse*, http://www.gruppohera.it/gruppo/comunicazione/news/pagina294.html, accessed 29/11/2011

MIPAAF (2011), *Communicato stampa: Ministro Romano: soddisfazione per il pieno utilizzo dei fondi destinati al comparto* vitivinicolo, http://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/4299, accessed 29/11/2011

SUSTAVINO (2009), www.sustavino.eu, accessed 02/08/2012

Books and articles

Adam, B. (1998), *Timescapes of modernity*, London: Routledge.

Atkins, P. (2010), *Liquid Materialities. A History of Milk, Science and the Law*, London: Ashgate.

Baker, S. (2007), 'Sustainable development as symbolic commitment: Declaratory politics and the seductive appeal of ecological modernisation in the European Union', *Environmental Politics*, 16(2): 297-317.

Barry, A. (2007), 'The Ethical Artifact: On Trash', in *Trash* J. Knechtel (ed.), Cambridge, MA: MIT Press: 196-213.

Bunker, S.G. and P. Ciccantell (2005), 'Matter, space, time and technology: how local process drives global systems', in P. Ciccantell ed., *Nature, raw materials and political economy*, London: Elsevier: 23–44.

Clark, J. and Murdoch, J. (1997), 'Local knowledge and the precarious extension of scientific networks: a reflection on three case studies', *Sociologia Ruralis*, 37 (1): 38-60.

Corona, G. and Nicoletti, G. (2010), 'Renewable energy from the production residues of vineyards and wine: Evaluation of a business case', *New Medit*, 9(4): 41-47.

Douglas, M. (1966), *Purity and danger: an analysis of the concepts of pollution and taboo*, London: Routledge and Kegan Paul.

Evans, D. (2011), 'Blaming the consumer – once again: the social and material contexts of everyday food waste practices in some English households', *Critical public health*, 21 (4): 429-440.

Evans, D. (2012) 'Beyond the Throwaway Society: Ordinary Domestic Practice and a Sociological Approach to Household Food Waste', *Sociology*, 46 (1): 43-58.

FitzSimmons, M. and Goodman, D. (1998), 'Incorporating nature: environmental narratives and the reproduction of food', in Braun. B., and Castree, N. (eds.), *Remaking reality: nature at the millennium*, London: Routledge: 194-220.

Gille, Z. (2010), 'Actor network, modes of production, and waste regimes: reassembling the macro-social', *Environment and Planning A*, 42: 1049-1064.

Gobin, A., Campling, P., Janssen, L., Desmet, N., van Delden, H., Hurkens, J., Lavelle, P., Berman, S. (2011), 'Soil organic matter management across the EU – best practices, constraints and trade-offs, Final Report for the European Commission's DG Environment', September 2011.

Gregson, N., and Crang, M. (2010), 'Materiality and waste: Inorganic vitality in a networked world', *Environment and Planning A*, 42 (5): 1026-1032.

Haila, Y. (2002), 'Scaling environmental issues: Problems and paradoxes', *Landscape and Urban Planning*, 61 (2-4): 59-69.

Horlings, L. G., and Marsden, T. K. (2011), 'Towards the real green revolution? Exploring the conceptual dimensions of a new ecological modernisation of agriculture that could 'feed the world'', *Global Environmental Change*, 21: 441-452.

Kaljonen, M. (2002), 'Co-construction of agency and environmental management. The case of agri-environmental policy implementation at Finnish farms', *Journal of Rural Studies*, 22: 205-216.

Korhonen, J. (2008), 'Reconsidering the economics logic of ecological modernization', *Environment and Planning A*, 40: 1331–46.

Latour, B. (1998), 'To modernise or ecologise? That is the question', in Braun. B., and Castree, N. (eds.), *Remaking reality: nature at the millennium*, London: Routledge: 220-241.

Lee, R., and Marsden, T. K. (2009), 'The globalization and re-localization of material flows: Four phases of food regulation', *Journal of Law and Society*, 36 (1): 129-144.

Lowe, P., Clark, J., Seymour, S., Ward, N. (1997), *Moralizing the Environment: Countryside Change, Farming and Pollution*, London: Routledge.

Macnaghten, P. and Urry, J. (1998), *Contested natures*, London: Sage.

Marsden, T. K. (2003), *The Condition of Rural Sustainability*, The Netherlands: Van Gorcum.

Marsden, T. K., Smith, E. (2005), 'Ecological entrepreneurship: sustainable development in local communities through quality food production and local branding', *Geoforum*, 36 (4): 440–451.

Matthews, R. and Selman, P. (2006), 'Landscape as a Focus for Integrating Human and Environmental Processes', *Journal of Agricultural Economics*, 57 (2): 199-212.

Meadowcroft, J. (2002), 'Politics and scale: some implications for environmental governance', *Landscape and Urban Planning*, 61: 169–179.

Mincyte, D. (2011), 'Subsistence and Sustainability in Post-industrial Europe: The Politics of Small-scale Farming in Europeanising Lithuania', *Sociologia Ruralis*, 51(2): 101-118.

Morgan, K., Marsden, T. and Murdoch, J. (2006), *Worlds of Food: Place, Power and Provenance in the Food Chain*, Oxford: Oxford University Press.

Newig, J. and Fritsch, O. (2009), 'Environmental Governance: Participatory, Multi-Level – and Effective?', *Environmental Policy and Governance*, 19: 197-214.

O'Brien, M. (2008), *A Crisis of Waste? Understanding the Rubbish Society*, London: Routledge.

Pellow, D. N., Schnaiberg, A., and Weinberg, A. S. (2000), 'Putting the Ecological Modernisation Thesis to the Test: The Promises and Performances of Urban Recycling', *Environmental Politics* 9(1): 109-137.

Quested, T. E., Parry, A. D., Easteal, S., and Swannell, R. (2011), 'Food and drink waste from households in the UK', *Nutrition Bulletin*, 36 (4):460-467.

Reno, J. (2009), 'Your Trash Is Someone's Treasure. The Politics of Value at a Michigan Landfill', *Journal of Material Culture*, 14 (1): 29-46.

Reno, J. (2011), 'Motivated Markets: Instruments and Ideologies of Clean Energy in the United Kingdom', *Cultural Anthropology*, 26(3): 389-413.

Ruggieri, L., Cadena, E., Martínez-Blanco, J., Gasol, C.M., Rieradevall, J., Gabarrell, X., Gea, T., Sort, X., and Sánchez, A. (2009), 'Recovery of organic wastes in the Spanish wine industry. Technical, economic and environmental analyses of the composting process', *Journal of Cleaner Production,* 17(9): 830-838.

Stengers, I. (1997), *Power and Invention: Situating Science*, Minneapolis, MN: University of Minnesota Press.

Unwin, T. (1991), *Wine and the vine: an historical geography of viticulture and the wine trade*, London: Routledge.

Van-Camp. L., Bujarrabal, B., Gentile, A-R., Jones, R.J.A., Montanarella, L., Olazabal, C. and Selvaradjou, S-K. (2004), 'Reports of the Technical Working Groups Established under the Thematic Strategy for Soil Protection EUR 21319 EN/3, 872 pp.', Luxembourg: Office for Official Publications of the European Communities.

Van Loon, J. (2002), *Risk and technological culture. Towards a sociology of virulence*, London: Routledge.

Van Loon, J., and Sabelis, I. (1997), 'Recycling Time: Temporal Complexity of Waste Management', *Time and Society*, 6: 287-306.

[i] Although see Stuart 2009 on some insights on food waste in production and distribution.

[ii] By bio-wastes I understand bio-degradable wastes of animal or plant origin. These materials need to be seen as distinct from non-biodegradable trash also produced in making and consuming foods.

[iii] The waste-related regulations I discuss in this paper apply to all producers alike, conventional, organic,

or biodynamic.

[iv] With the exception of Caviro, all wineries and persons in this texts have been given pseudonyms.

[v] Grape marc are the grape skins, pulp, pips, seeds, stems, yeast and juice which are left over from wine pressing and fermentation. For a 100 kg of grapes, one can expected to obtain between 20 and 30kg of marc.

[vi] Source: Provincia di Ravenna (2008) Provvedimento n. 703 del 23/12/2008